Crime Analysis Database

- Class : DAMG6210
- CRN : 16149
- Team Name: Crime Board
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Summary

The objective of our database is to have a centralized data source that would cater to any crime analysis system. It would be able to provide an efficient database for various use cases such as:

- Real Estate - Provide a database to have data visualization for the crime rate in a locality.
- Law Enforcement - Provide law enforcement a source to gather and track the various crimes around their jurisdiction.
- Location Service - Navigation services such as Google Maps can have an option to provide the safest route from Point A to Point B.
- Tourist Destinations - Make tourists aware of a particular area's safety before they visit.

The data would be collected through various sources to collate and create a new database that would be able to answer questions on the data like how crime has progressed, what type of crimes take place, and their severity and provide a correlation between various factors(gross income of an area, time, etc) and crime committed, etc.

Steps taken:

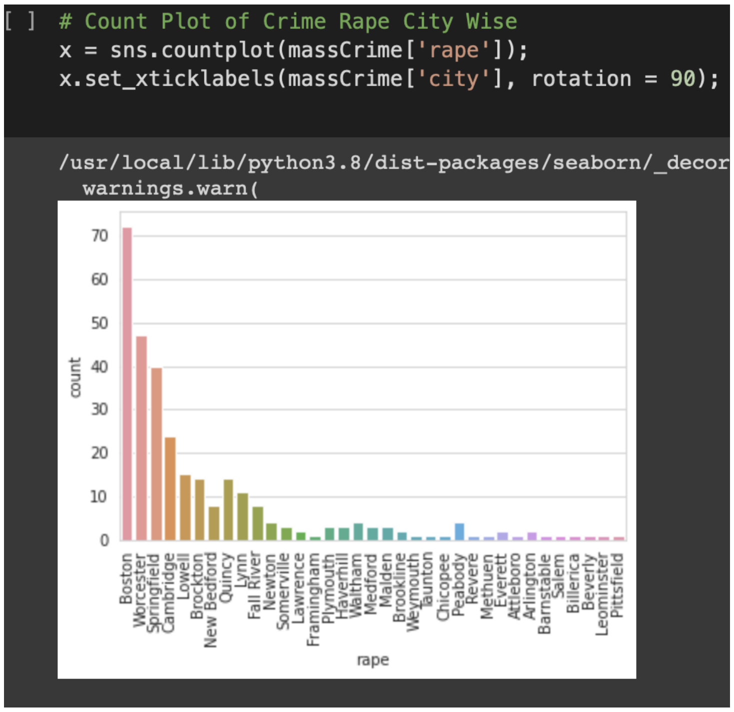
Sourcing Data:

1) Twitter: We collated tweets data to gather various incidents or conversations regarding crime. We did this by using a twitter scrapper bot coded in python that would crawl for specific key words regarding to crime like murder, rape, gunshot etc and would gather the various details like tweet text, meta data of the tweet like tweet id, like count etc and also the user details.
2) Crime data: For the crime data we used the official datasets from the Boston Police department.

Munging and cleaning the data:

- We imported the data sets as csv files and parse it using the pandas library in python.
- Once the data was made into a data frame, we utilized the various transformation functions available in the pandas library to handle the data issues like incomplete, duplicates and corrupted data.

Auditing the data:



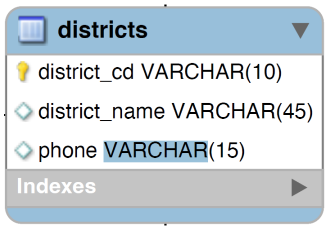
```
[ ]  # Count Plot of Crime Rape City Wise
     x = sns.countplot(massCrime['rape']);
     x.set_xticklabels(massCrime['city'], rotation = 90);

     /usr/local/lib/python3.8/dist-packages/seaborn/_decor
       warnings.warn(
```

After cleaning the data, we analyzed it and discovered some useful insights, such as the fact that Boston has the highest number of crimes in all categories in the state of Massachusetts.

Loading the data into a database:

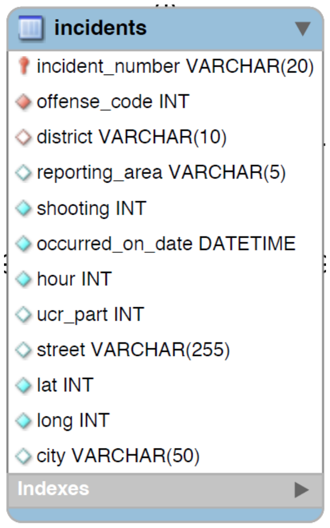
- Once the data was cleaned and validated, we loaded the transformed data frames into a MySQL database system.
- The data was loaded into the following tables:
    - Districts : The table contained the various districts in and around boston.



districts
- district_cd VARCHAR(10)
- district_name VARCHAR(45)
- phone VARCHAR(15)

Indexes

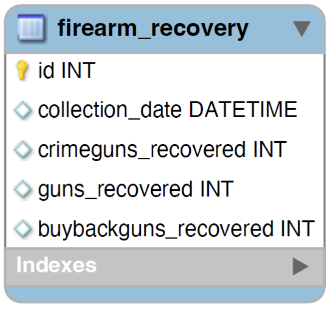
    - Incidents: The table contains the incident reports by the BDP.



incidents
- incident_number VARCHAR(20)
- offense_code INT
- district VARCHAR(10)
- reporting_area VARCHAR(5)
- shooting INT
- occurred_on_date DATETIME
- hour INT
- ucr_part INT
- street VARCHAR(255)
- lat INT
- long INT
- city VARCHAR(50)

Indexes

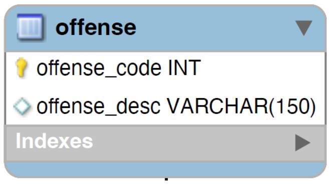
    - Firearm_recovery: The table contains the various firearms recovered during a crime bust and also that were turned in or retired.



firearm_recovery
- id INT
- collection_date DATETIME
- crimeguns_recovered INT
- guns_recovered INT
- buybackguns_recovered INT

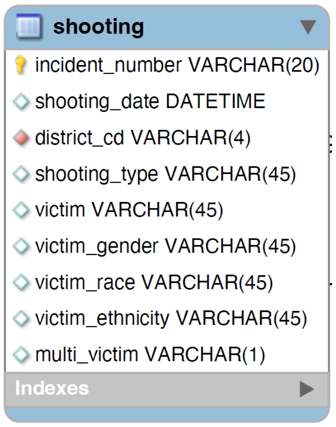
Indexes

- Offense: It contains the data regarding the official offense codes and their descriptions



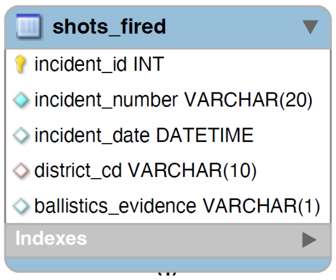
offense
offense_code INT
offense_desc VARCHAR(150)
Indexes

- Shooting: it contains data regarding the incidents that involved shootings and various parameters related to it.



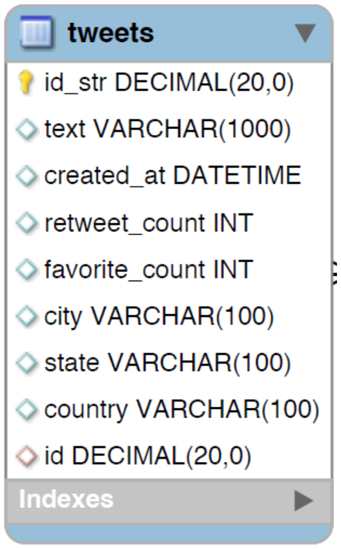
shooting
incident_number VARCHAR(20)
shooting_date DATETIME
district_cd VARCHAR(4)
shooting_type VARCHAR(45)
victim VARCHAR(45)
victim_gender VARCHAR(45)
victim_race VARCHAR(45)
victim_ethnicity VARCHAR(45)
multi_victim VARCHAR(1)
Indexes

- Shots_fired: it contains the data related to reports of gunshots that have been recorded from various sources.

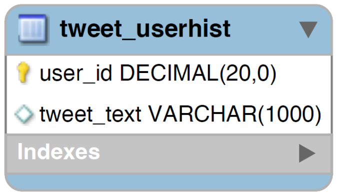


shots_fired
incident_id INT
incident_number VARCHAR(20)
incident_date DATETIME
district_cd VARCHAR(10)
ballistics_evidence VARCHAR(1)
Indexes

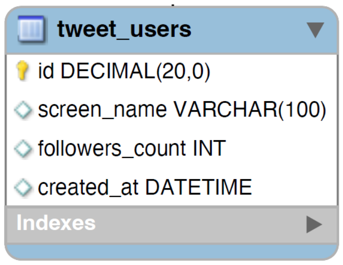
- Tweets: it contains the data related to tweets that were scrapped using the twitter bot



- Tweet_userhist: it is used to record the user activity of the users in the tweets table and record the tweets within the last 24 hours.



- Tweet_users: it is used to record the user's data like user id, followers etc.



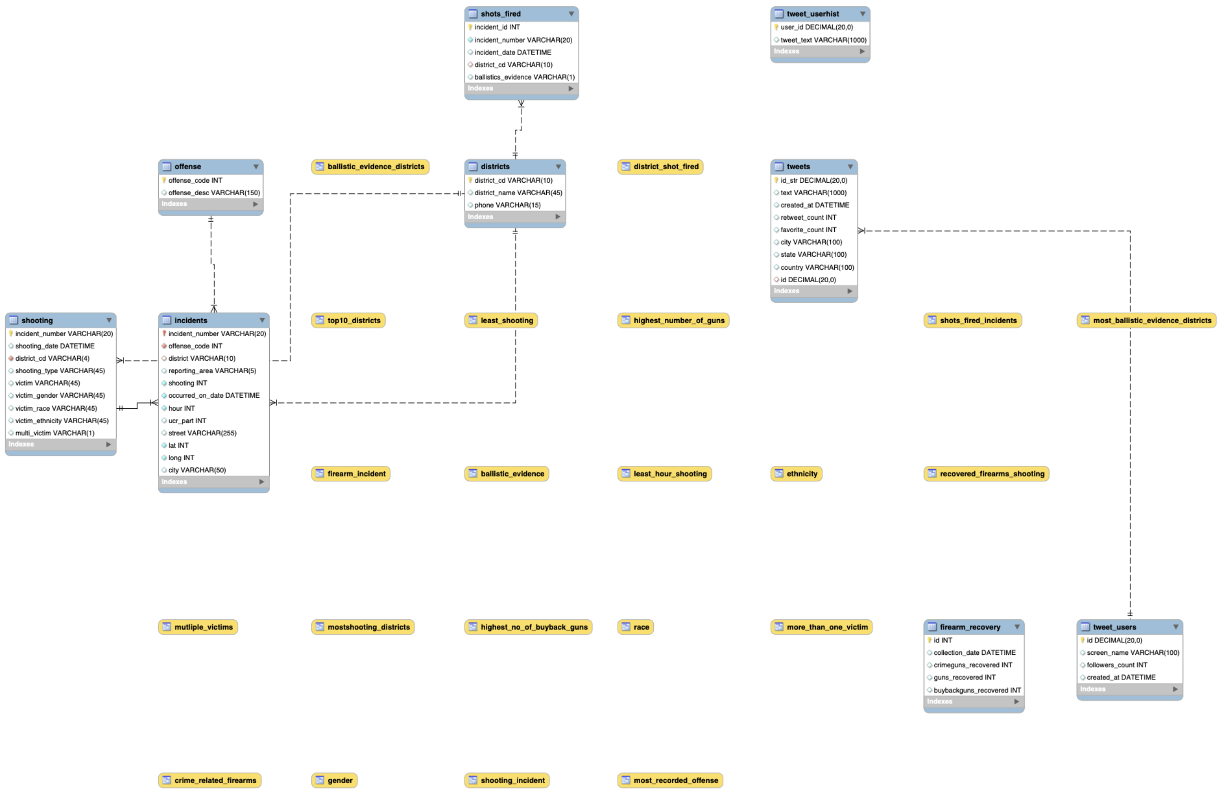
Normalization:

We have done the normalization for the tables. For converting to 1st Normal Form (1NF), we have identified a unique primary key for all the tables. Additionally we removed columns having atomic values and eliminated repeating groups.

For 2nd Normal Form (2NF), we have ensured the database is in first normal form. Then we removed all partial dependencies between the primary keys. For this we ensured that the offense description field, which was initially in the incidents table, was eliminated as it could be linked to the offense master table, which has the primary key as offense_code. Additionally we removed attributes like day incident occurred on, as it can be derived from the date field already available in the incidents table.

Our Database was mostly in 3rd Normal Form (3NF), and we ensured that there were no transitive dependencies between any fields in our tables. Please find below the ER Diagram after normalization was done:

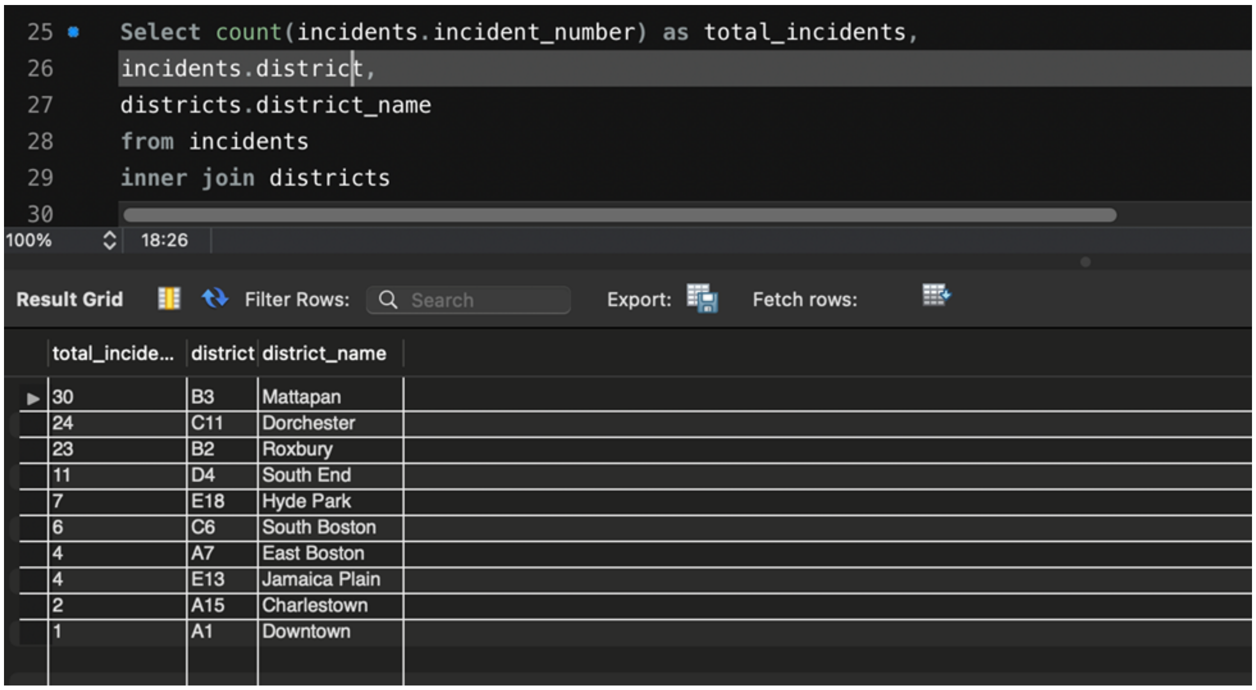
ER Diagram After Normalization.



USE CASES

Please find below some use cases which we have displayed:

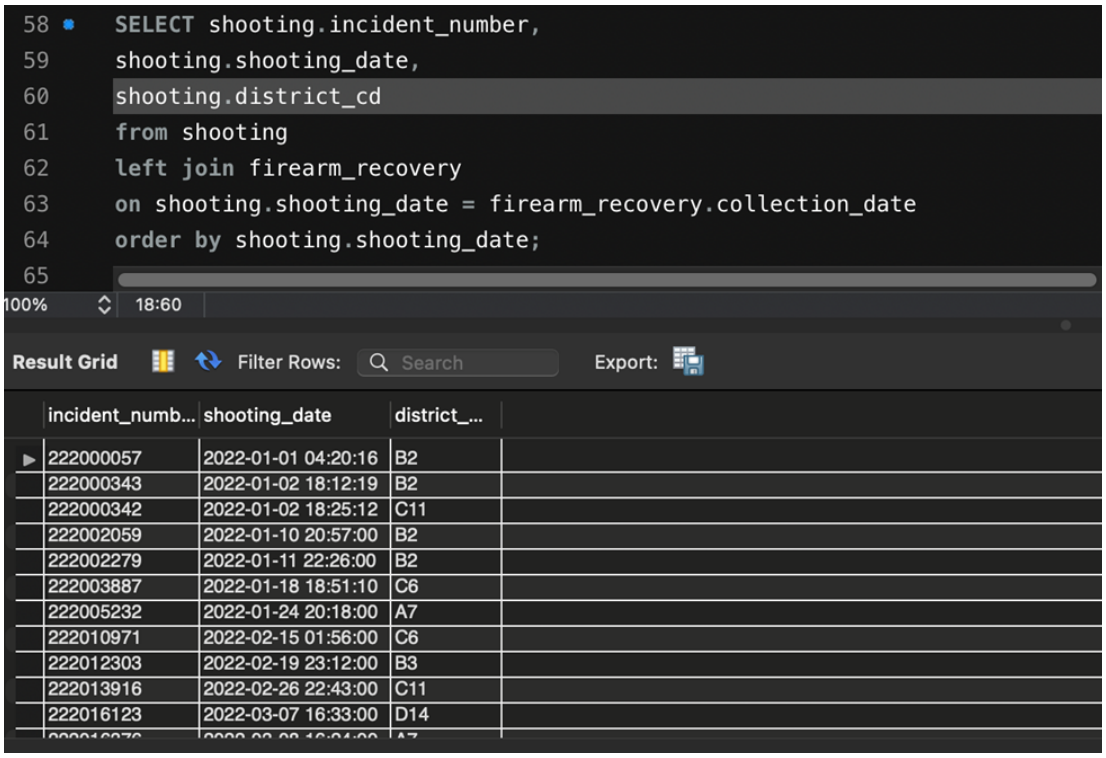
1. What are the top 10 districts that have the most incident reports?
   Select count(incidents.incident_number) as total_incidents,
   incidents.district,
   districts.district_name
   from incidents
   inner join districts
   on incidents.district = districts.district_cd
   group by incidents.district
   order by total_incidents desc
   limit 10;



```
Select count(incidents.incident_number) as total_incidents,
incidents.district,
districts.district_name
from incidents
inner join districts
```

total_incide...	district	district_name
30	B3	Mattapan
24	C11	Dorchester
23	B2	Roxbury
11	D4	South End
7	E18	Hyde Park
6	C6	South Boston
4	A7	East Boston
4	E13	Jamaica Plain
2	A15	Charlestown
1	A1	Downtown

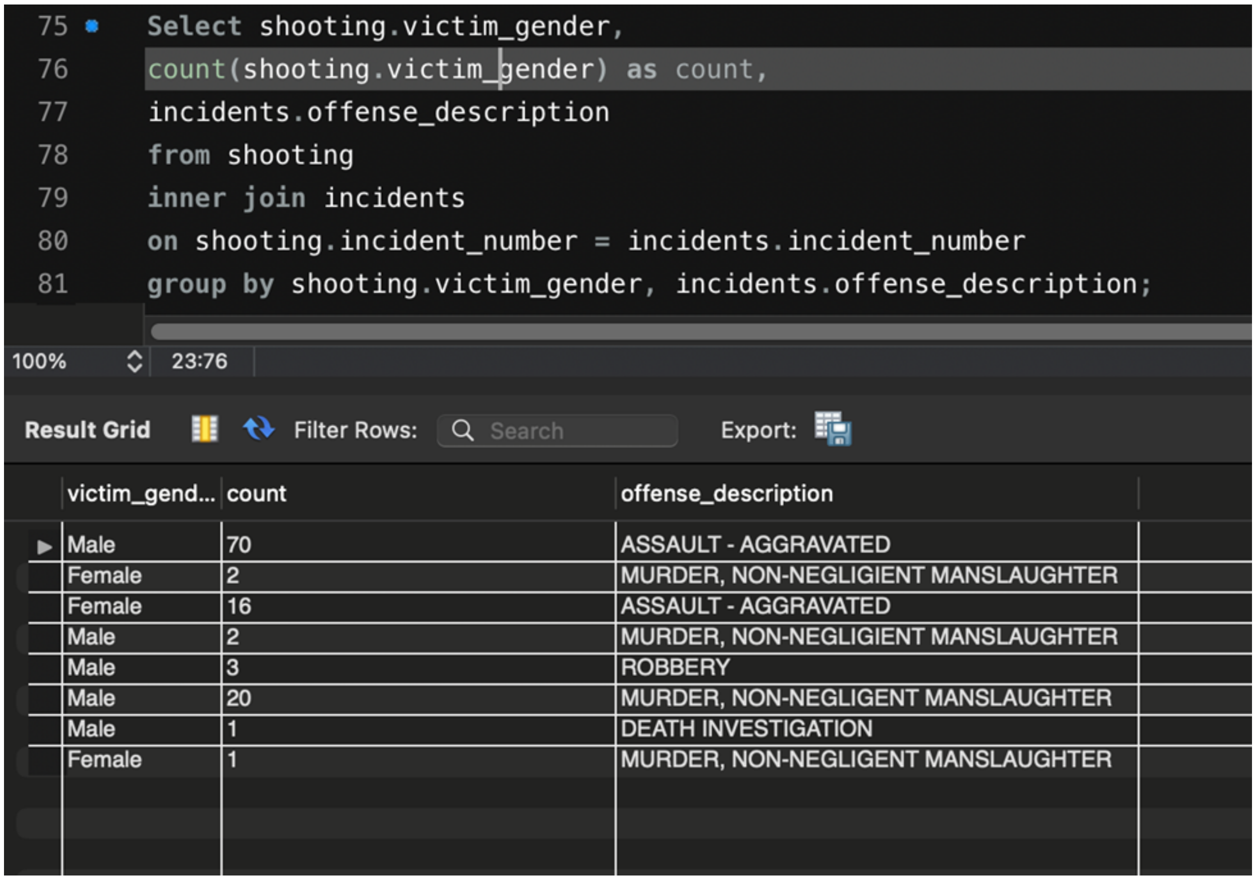
2. Were firearms recovered on the dates when shootings occurred?
   SELECT shooting.incident_number,
   shooting.shooting_date,
   shooting.district_cd
   from shooting
   left join firearm_recovery
   on shooting.shooting_date = firearm_recovery.collection_date
   order by shooting.shooting_date;



```
SELECT shooting.incident_number,
shooting.shooting_date,
shooting.district_cd
from shooting
left join firearm_recovery
on shooting.shooting_date = firearm_recovery.collection_date
order by shooting.shooting_date;
```

incident_numb...	shooting_date	district_...
222000057	2022-01-01 04:20:16	B2
222000343	2022-01-02 18:12:19	B2
222000342	2022-01-02 18:25:12	C11
222002059	2022-01-10 20:57:00	B2
222002279	2022-01-11 22:26:00	B2
222003887	2022-01-18 18:51:10	C6
222005232	2022-01-24 20:18:00	A7
222010971	2022-02-15 01:56:00	C6
222012303	2022-02-19 23:12:00	B3
222013916	2022-02-26 22:43:00	C11
222016123	2022-03-07 16:33:00	D14

3. Which gender was involved with the most shooting?
   Select shooting.victim_gender,
   count(shooting.victim_gender) as count,
   incidents.offense_description
   from shooting
   inner join incidents
   on shooting.incident_number = incidents.incident_number
   group by shooting.victim_gender, incidents.offense_description;



```
Select shooting.victim_gender,
count(shooting.victim_gender) as count,
incidents.offense_description
from shooting
inner join incidents
on shooting.incident_number = incidents.incident_number
group by shooting.victim_gender, incidents.offense_description;
```

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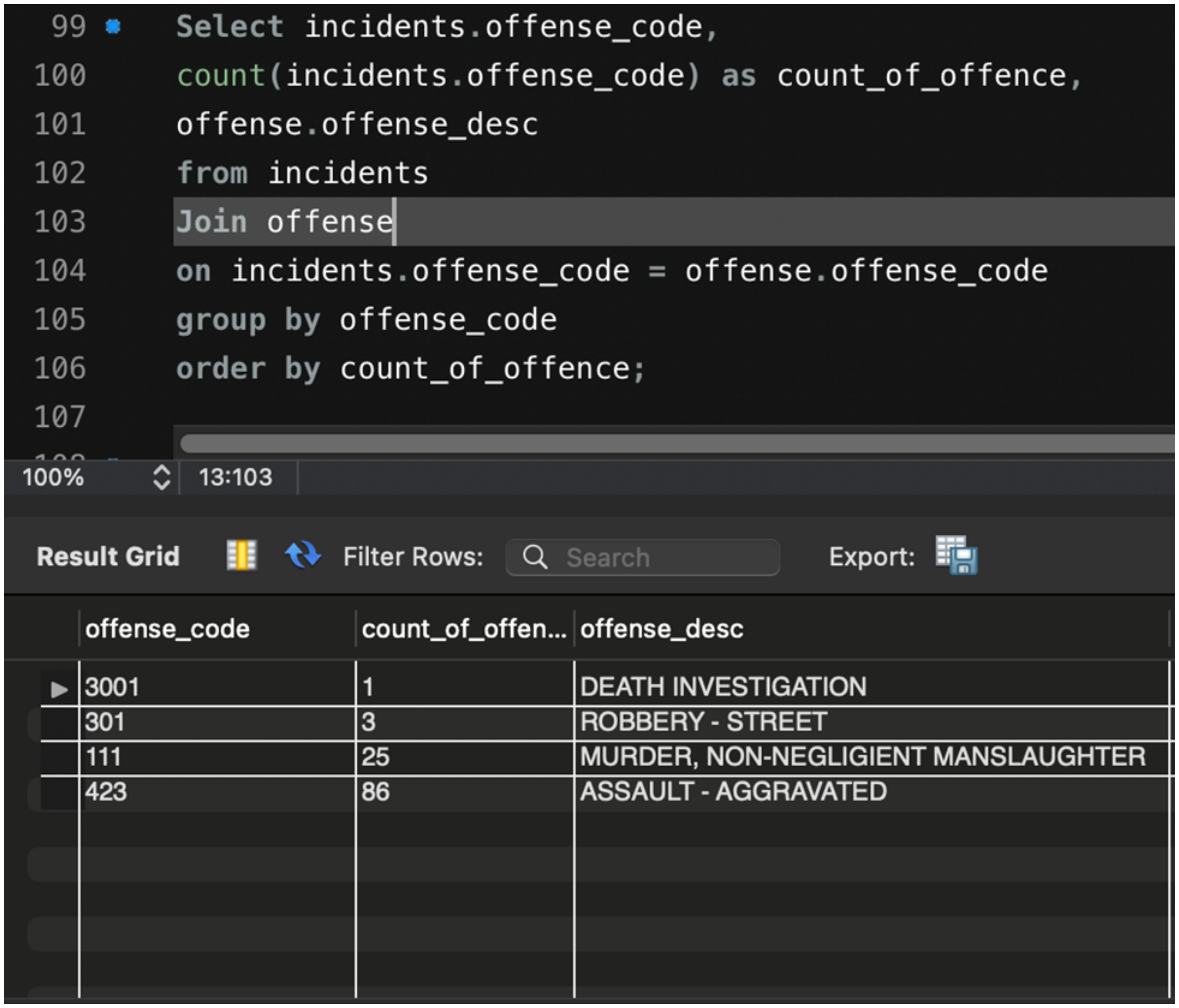
Result Grid Filter Rows: Search Export:

victim_gend...	count	offense_description
Male	70	ASSAULT - AGGRAVATED
Female	2	MURDER, NON-NEGLIGIENT MANSLAUGHTER
Female	16	ASSAULT - AGGRAVATED
Male	2	MURDER, NON-NEGLIGIENT MANSLAUGHTER
Male	3	ROBBERY
Male	20	MURDER, NON-NEGLIGENT MANSLAUGHTER
Male	1	DEATH INVESTIGATION
Female	1	MURDER, NON-NEGLIGENT MANSLAUGHTER

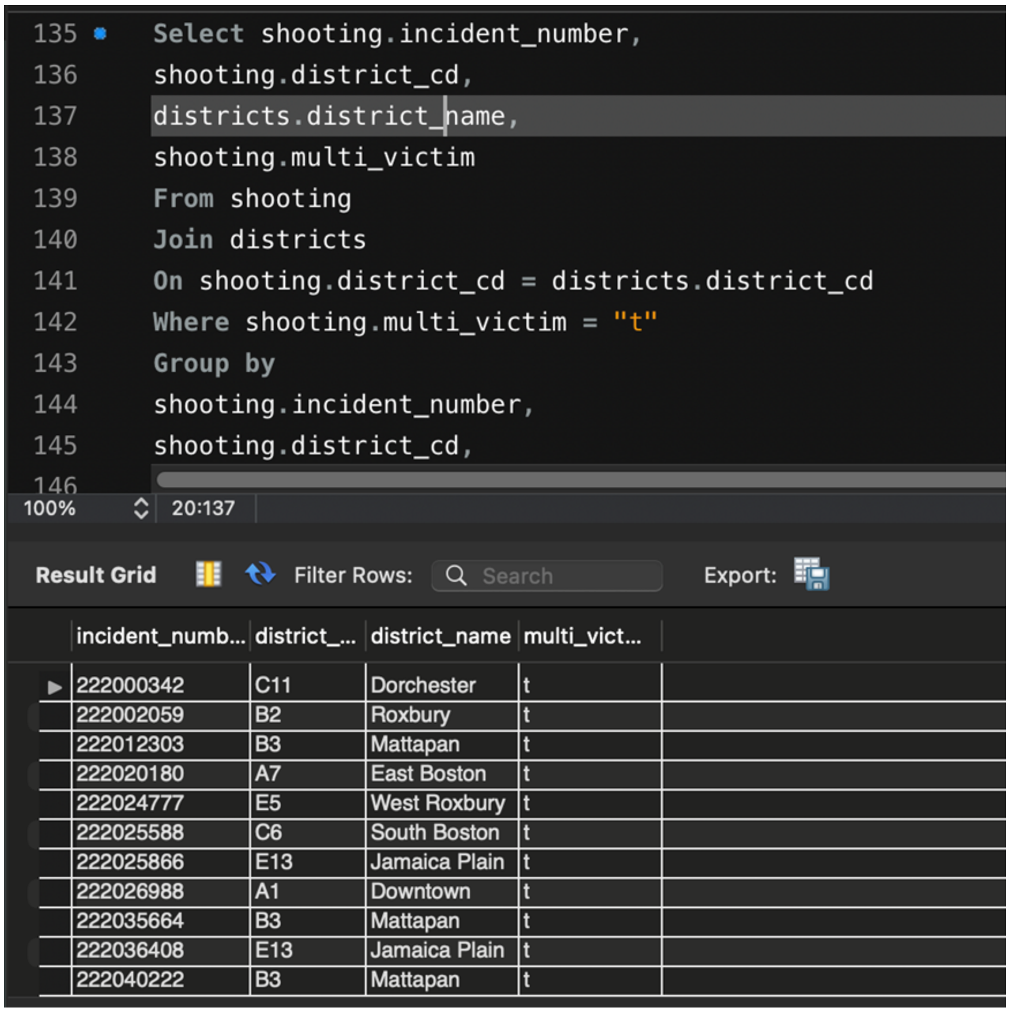
4. Which type of offense is the most recorded?
   Select incidents.offense_code,
   count(incidents.offense_code) as count_of_offence,
   offense.offense_desc
   from incidents
   Join offense
   on incidents.offense_code = offense.offense_code
   group by offense_code
   order by count_of_offence;



```
Select incidents.offense_code,
count(incidents.offense_code) as count_of_offence,
offense.offense_desc
from incidents
Join offense
on incidents.offense_code = offense.offense_code
group by offense_code
order by count_of_offence;
```

offense_code	count_of_offen...	offense_desc
3001	1	DEATH INVESTIGATION
301	3	ROBBERY - STREET
111	25	MURDER, NON-NEGLIGIENT MANSLAUGHTER
423	86	ASSAULT - AGGRAVATED

5. Which district had more than 1 victim?
   Select shooting.incident_number,
   shooting.district_cd,
   districts.district_name,
   shooting.multi_victim
   From shooting
   Join districts
   On shooting.district_cd = districts.district_cd
   Where shooting.multi_victim = "t"
   Group by
   shooting.incident_number,
   shooting.district_cd,
   districts.district_name,
   Shooting.multi_victim;



```
Select shooting.incident_number,
shooting.district_cd,
districts.district_name,
shooting.multi_victim
From shooting
Join districts
On shooting.district_cd = districts.district_cd
Where shooting.multi_victim = "t"
Group by
shooting.incident_number,
shooting.district_cd,
```

incident_numb...	district_...	district_name	multi_vict...
222000342	C11	Dorchester	t
222002059	B2	Roxbury	t
222012303	B3	Mattapan	t
222020180	A7	East Boston	t
222024777	E5	West Roxbury	t
222025588	C6	South Boston	t
222025866	E13	Jamaica Plain	t
222026988	A1	Downtown	t
222035664	B3	Mattapan	t
222036408	E13	Jamaica Plain	t
222040222	B3	Mattapan	t